DESIGNED FOR MASS-PRODUCTION

Clever Detail Design of the Fairey Battle : Extensive Use of Jigs and Press Tools

IT has now become possible to disclose details of the Fairey Battle medium bomber, which is one of the new types of military aircraft selected for large-scale production, partly by the original designers and partly by one of the "shadow" factories. The Fairey works at Stockport are already turning out these machines at a highly satisfactory rate, and shadow production in even greater numbers will follow. In *Flight* of June 17, 1937, was published an article and a number of photographs which dealt with the machine in production at the Stockport factory. As a result of further visits by members of *Flight's* staff, we are able to describe and illustrate in the following pages the details of the primary structure of the Battle, in the design of which rapid mass-production has been kept prominently in mind without sacrificing either aerodynamic or structural efficiency.

Preparing for Production

Some have expressed surprise that it has taken so long to get into real quantity production with the Battle. The real cause for surprise is not that it should have taken so long, but that it has gone into production so quickly. Be it remembered that, although the Fairey factory at Stockport was in existence and producing before the Battle came along, the amount of tooling necessary before there were any visible signs of progress was prodigious. To all intents and purposes no single part of the Battle is hand-made. Dies and press tools have had to be designed and made before even the smallest trickle of "bits and pieces" could begin to flow. And the jigs on which the fuselages and wings are assembled are marvels of ingenuity. This is not a description of Fairey production methods, but it may be mentioned that the fuselage jig, for example, has to hold rings and supports on which the planking can be assembled, and that when the shell is completed the multitude of claws which hold all these components have to be capable of being retracted inwards in order to allow the fuselage shell to be withdrawn from the jig.

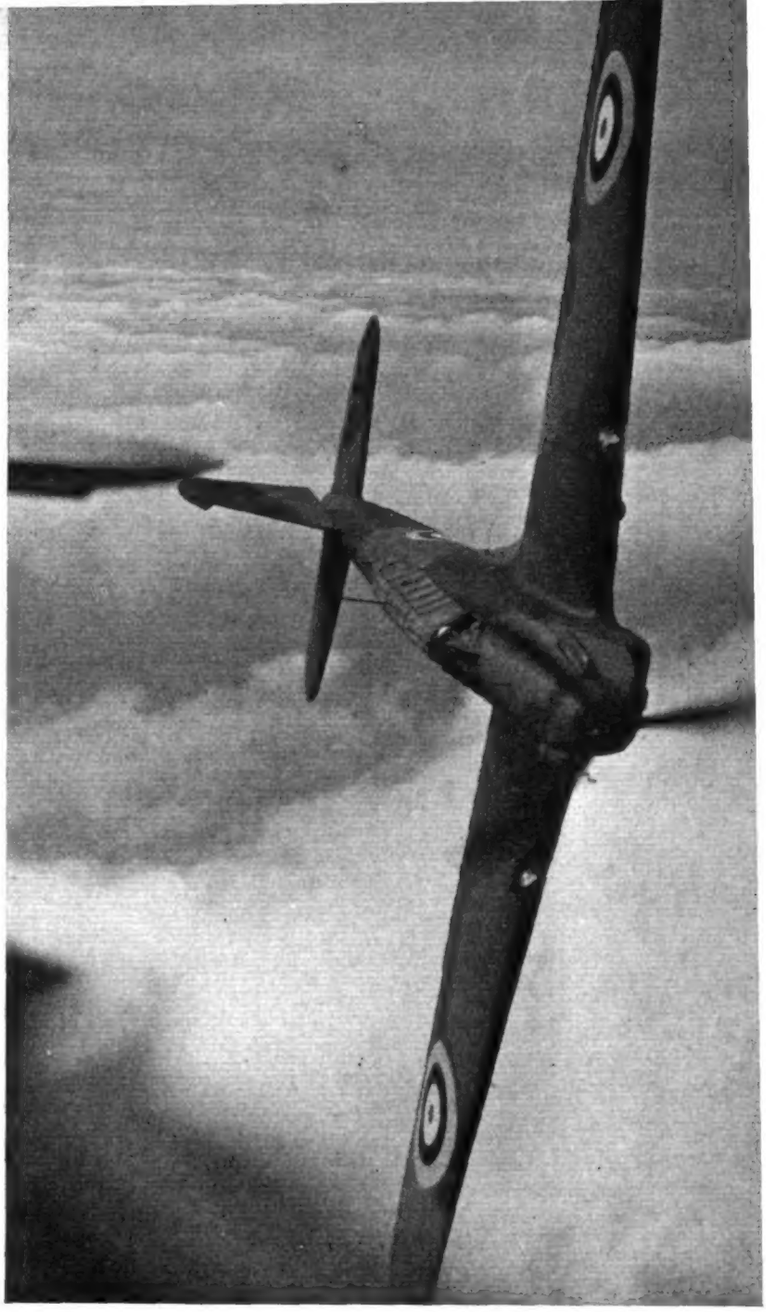
Flight drew attention, more than a year ago, to the problem of installing equipment in a fuselage of monocoque construction, particularly if the fuselage is of fairly modest dimensions. In a large machine there is usually room for the men to move about. In the Battle the difficulty has been overcome by using a composite form of construction, the rear portion of the fuselage being a monocoque shell, while the front portion, from airscrew to aft of the cockpits, is a steel tube girder. As nearly the entire equipment is contained in the front portion, the "get-at-ability" of the older types of fuselage is retained.

The *motif* of the primary structure of the Battle fuselage rear portion is provided by formers or rings of "Z" section, to which is riveted the planking. There are no stringers in the accepted sense of the word, their place being taken by forming a curled-over lip on one edge of each "plank." This lip stiffens the planking in much the same way as does the more usual riveted-on stringer, and has the advantage that a single line of rivets suffices where two lines would be needed with the separate stringer type of construction.

For a good many years designers of flying boats were undecided whether it was the best practice to joggle the stringers of a flying boat hull into the frames, or to interrupt the stringers at the frames, leaving the latter uncut. Even now there is no unanimity on the subject, some designers preferring one method, others the other, and some designers even using the one system in one of their types and the other in another type of flying boat. The problem was solved for the Fairey designers automatically when the lip-edge planking was chosen. Obviously, it would be a cumbersome business to cut the lips of the planks at every frame, and so in the Battle the frames are notched for the lips of the planks.

The planks of the fuselage are quite narrow, some six inches on an average, but relatively long. They are joined by butt joints, the actual joint being reinforced by a small plate, as shown in one of our sketches. The plank ends are riveted to this plate and to the frame underneath it. The interior of a fuselage of this type is, of course, very clean and free of obstructions such as the tie rods or struts found in girder-type fuselages.

In the above comments on the fuselage of the Fairey Battle use has been made of the expression monocoque. This needs some qualification, and semi-monocoque would be a more accurate description, as the fuselage is not strictly speaking a plain shell, longerons being used at approximately the positions where the corners would be if the fuselage were of rectangular instead of oval cross-section. These four longerons are, like a good many other



Manœuvrability has not been sacrificed to performance, as indicated in this picture of the Battle in a vertical bank. The pilot is Flt. Lt. C. S. Staniland, Fairey's chief test pilot. (*Flight* photograph.)